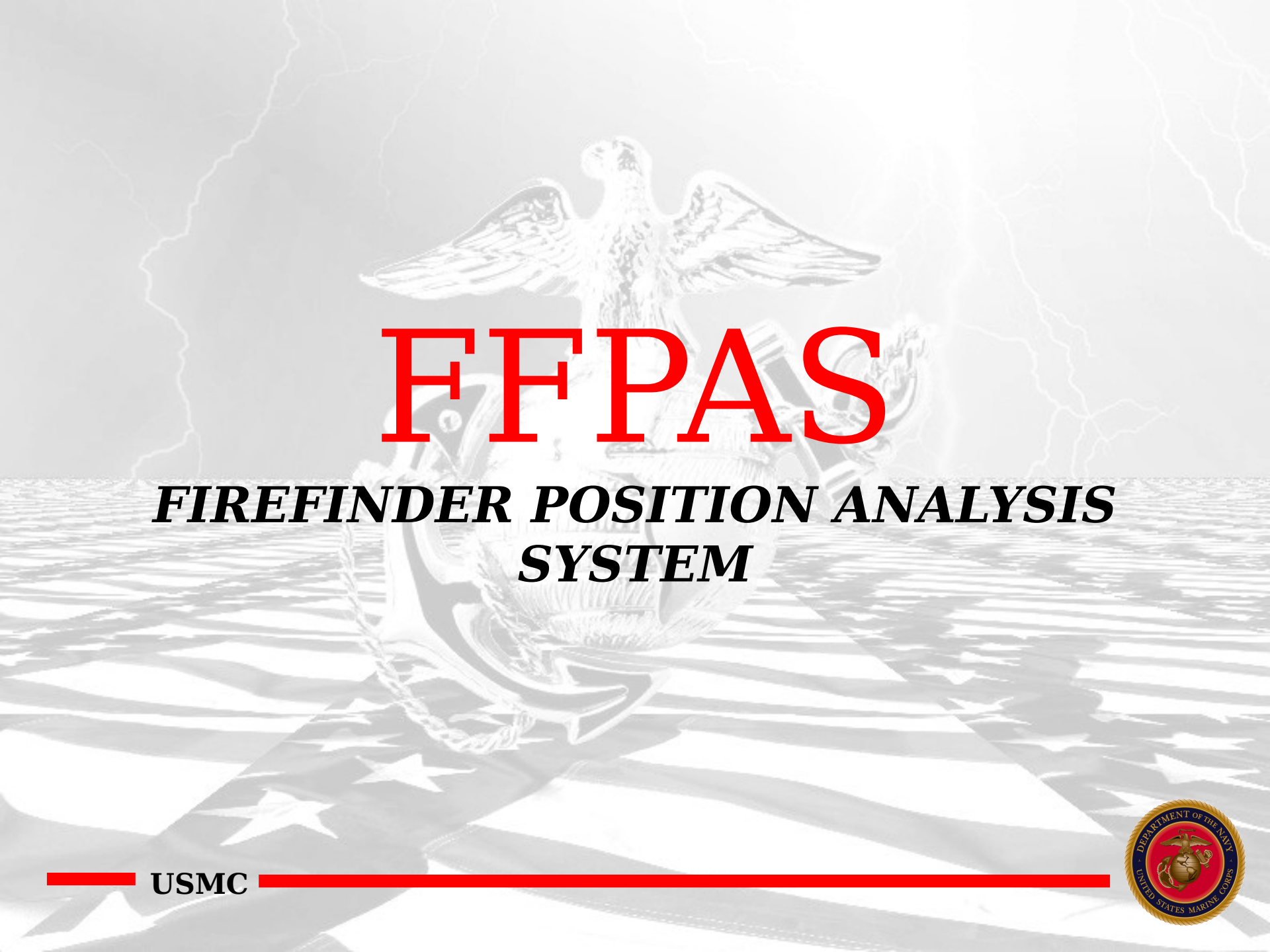




FFPAS

***FIREFINDER POSITION ANALYSIS
SYSTEM***

USMC



INTRODUCTION

- FFPAS IS A SOFTWARE TOOL THAT FACILITATES THE SITING OF AN/TPQ-36, 46 AND AN/TPQ-37 FIREFINDER RADARS
- FFPAS USES DIGITAL TERRAIN DATA AND DETAILED RADAR AND WEAPON MODELS TO PREDICT SITE-SPECIFIC FIREFINDER PERFORMANCE



- *FFPAS ANALYSES CONSIDER:*

- LINE-OF-SIGHT (LOS) TARGET AND CLUTTER VISIBILITY

- TARGET RANGE, VELOCITY AND RADAR CROSS SECTION

- GROUND CLUTTER RETURN STRENGTH

- SECTOR WIDTH REQUIREMENTS



FFPAS

CHARACTERISTICS

- EVALUATES TRAJECTORY VISIBILITY
FOR MULTIPLE WEAPON TYPES

- MORTARS*

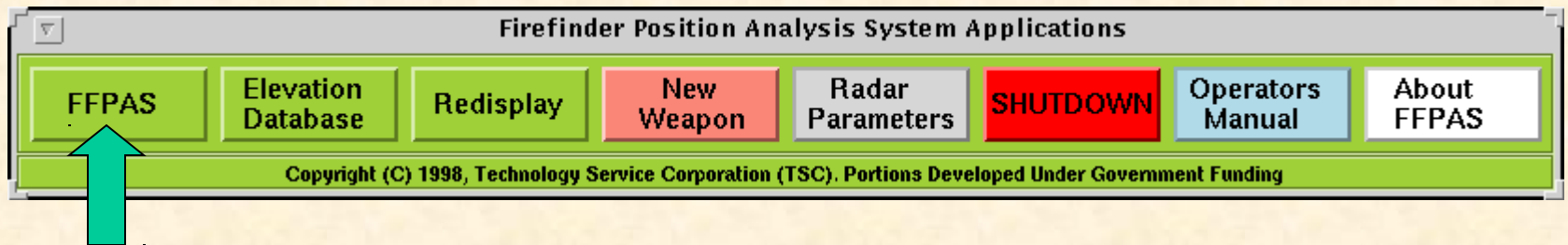
- ARTILLERY*

- ROCKETS*



FFPAS

- EVALUATES PERFORMANCE OF FIREFINDER RADAR AT USER SPECIFIED LOCATION



FFPAS MAIN MENU



- FIRST: CONSTRUCT ANALYSIS SCENARIO
 - 1. SELECT RADAR SET
 - 2. SELECT TERRAIN DATABASE
 - 3. SPECIFY RADAR LOCATION
 - 4. SET UP RADAR SEARCH FENCE
 - 5. SPECIFY WEAPON TRAJECTORY



FFPAS MAIN MENU

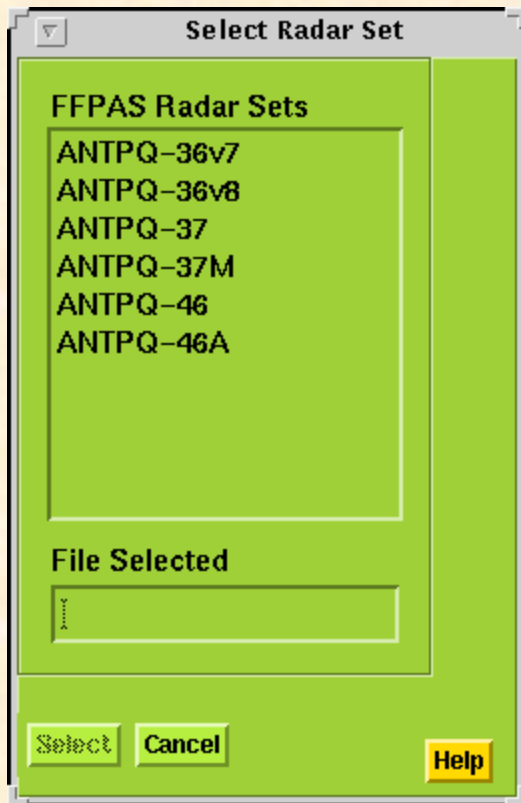
(cont.)



- THEN: GENERATE PERFORMANCE OUTPUTS
 - TERRAIN PLOT
 - SCREEN ANGLE PLOT
 - ELEVATION PLOT
 - CLUTTER PLOT
 - VISIBILITY PLOT
 - TRAJECTORY TARGET-TO-INTERFERENCE PLOT
 - PERFORMANCE SPREADSHEET



CONSTRUCT ANALYSIS SCENARIO



1. SELECT RADAR SET

- MENU CONTAINING RADAR LIST APPEARS AUTOMATICALLY OVER FFPAS MAIN MENU
- CLICK ON NAME OF DESIRED RADAR SET
- CLICK ON SELECT TO SAVE AND RETURN TO FFPAS MAIN MENU



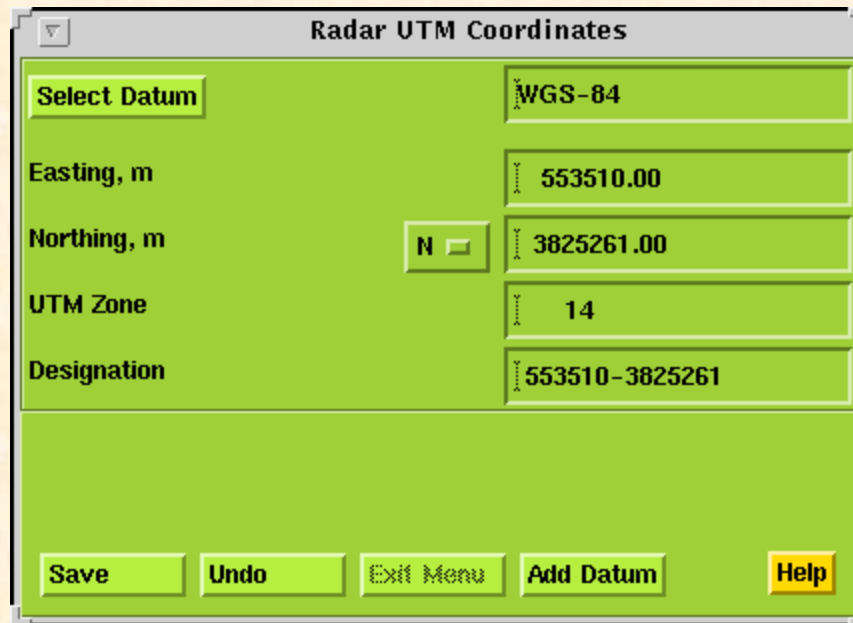
2. SELECT TERRAIN DATABASE



- CLICK ON DESIRED DATABASE
- CLICK ON GET DATA BUTTON
- DATABASE LOADS AND POSITION RADAR BUTTON IS ACTIVATED
- DELETE DATA BUTTON REMOVES FILE FROM DISK PERMANENTLY



3. *SPECIFY RADAR LOCATION*



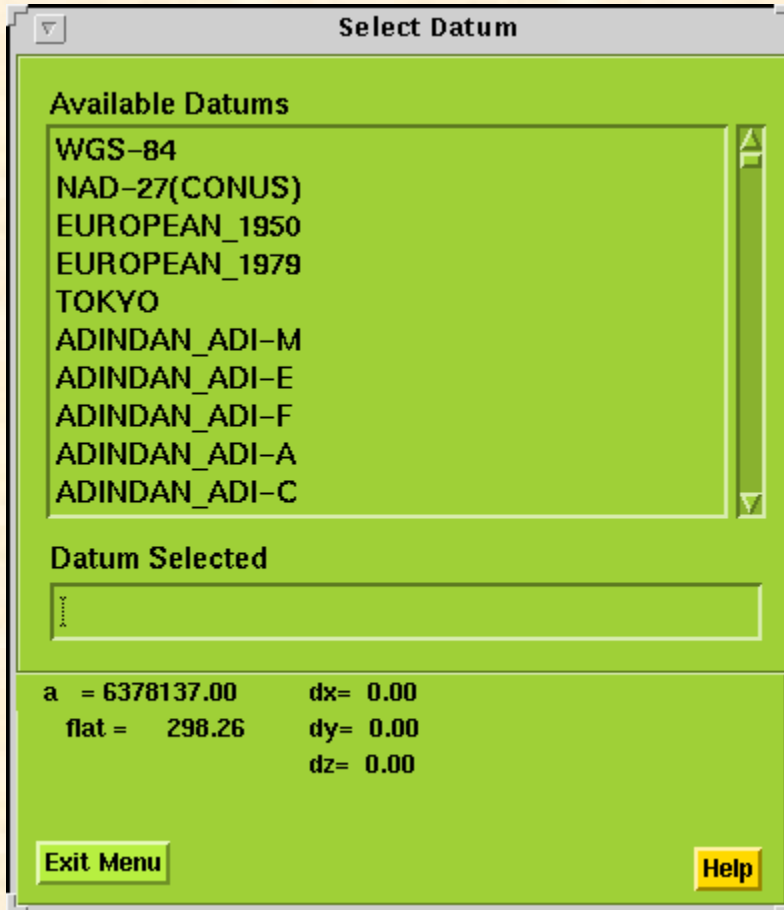
The screenshot shows a software window titled "Radar UTM Coordinates". It contains several input fields and buttons. The "Select Datum" field is set to "WGS-84". The "Easting, m" field contains "553510.00". The "Northing, m" field contains "3825261.00" and has a small "N" button next to it. The "UTM Zone" field contains "14". The "Designation" field contains "553510-3825261". At the bottom, there are five buttons: "Save", "Undo", "Exit Menu", "Add Datum", and "Help".

Field	Value
Select Datum	WGS-84
Easting, m	553510.00
Northing, m	3825261.00
UTM Zone	14
Designation	553510-3825261

- CLICK ON POSITION RADAR BUTTON ON FFPAS MAIN MENU TO OPEN RADAR UTM COORDINATES MENU
- SELECT LOCAL DATUM FROM COMPLETE LIST OF DMA-SUPPLIED DATUMS
- ENTER UTM EASTING, NORTHING AND GRID ZONE OF LOCATION
- 15 CHARACTER ALPHANUMERIC DESIGNATION CAN BE SPECIFIED



SELECT DATUM



- CLICK SELECT DATUM BUTTON ON RADAR UTM COORDINATES MENU
- FIND LOCAL DATUM IN LIST AND CLICK TO SELECT
- CLICK EXIT MENU TO RETURN TO RADAR UTM COORDINATES MENU
- ALL MENU AND DISPLAY COORDINATES WILL BE REFERENCED TO SELECTED LOCAL DATUM
- DEFAULT DATUM IS WGS-84



4. SET UP RADAR SEARCH FENCE



- SET SEARCH FENCE BUTTON IS ACTIVATED ONCE RADAR COORDINATES ARE SET
- RADAR SEARCH FENCE MUST BE SPECIFIED PRIOR TO WEAPON TRAJECTORIES
- CLICK ON SET SEARCH FENCE BUTTON



4. SET UP RADAR SEARCH FENCE (cont.)

Search Fence

Antenna Azimuth (mils) 800

Lower Frequency Limit 0

Upper Frequency Limit 31

Left Sector Edge (mils) -800

Right Sector Edge (mils) 800

Minimum Search Range (km) 0.75

Maximum Survey Range (km) 24.00

☐ Survey Terrain ☐ Manual Terrain Mask

Minimum Mask Angle (mils) 20.00

☒ Flat Mask ☐ Terrain Following

☒ Video Int OFF ☐ Video Int ON

Save Undo Cancel Exit Menu Help

- ENTER:
- *ANTENNA AZIMUTH*
 - *FREQUENCY LIMITS*
 - *SECTOR EDGES*
 - *MIN & MAX SECTOR RANGES*



4. SET UP RADAR SEARCH FENCE (cont.)

Search Fence

Antenna Azimuth (mils) 800

Lower Frequency Limit 0

Upper Frequency Limit 31

Left Sector Edge (mils) -800

Right Sector Edge (mils) 800

Minimum Search Range (km) 0.75

Maximum Survey Range (km) 24.00

_ Survey Terrain _

_ Manual Terrain Mask _

Minimum Mask Angle (mils) 20.00

Flat Mask Terrain Following

Video Int OFF Video Int ON

Save Undo Cancel Exit Menu Help

- CLICK ON SURVEY TERRAIN BUTTON TO LOAD DIGITAL MASK

- CLICK ON MANUAL TERRAIN MASK BUTTON TO ENTER OR MODIFY MASK

- CLICK MINIMUM MASK ANGLE BUTTON TO SELECT OPTIMUM VALUE, OR ENTER VALUE IN TEXT FIELD

- SELECT FLAT MASK OR TERRAIN FOLLOWING SEARCH FENCE

- SELECT VIDEO INTEGRATION ON/OFF

- CLICK ON SAVE THEN EXIT MENU



5. SPECIFY WEAPON TRAJECTORY



- ONCE SEARCH FENCE SETTINGS ARE SAVED, HOSTILE WEAPON LOCATION AND FRIENDLY FIRE LOCATION BUTTONS ARE ACTIVATED
- PLOTS AVAILABLE:
TERRAIN
SCREEN ANGLE
ELEVATION
CLUTTER
VISIBILITY



HOSTILE WEAPON LOCATION

- SPECIFIED TRAJECTORY IS GENERATED AND ANALYZED, WITH GRAPHICAL AND TABULAR PERFORMANCE RESULTS DISPLAYED ON VARIOUS OUTPUTS
- SINGLE WEAPON TRAJECTORY ANALYSIS
 - POINT-TO-POINT
 - AREA-TO-AREA
- MULTIPLE WEAPON TRAJECTORY ANALYSIS
 - UP TO FIVE WEAPONS SIMULTANEOUSLY FIRED
 - SHOTS CAN BE FIRED INDEPENDENTLY (“BATCH” MODE)
- VOLLEY FIRE TRAJECTORY ANALYSIS



SINGLE WEAPON TRAJECTORY POINT-TO-POINT

- ON FFPAS MAIN MENU, CLICK ON HOSTILE WEAPON LOCATION -> SINGLE WEAPON TRAJECTORY
- SELECT WEAPON TYPE
 - LIGHT, MEDIUM, HEAVY MORTAR
 - LIGHT, MEDIUM, HEAVY ARTILLERY
 - SHORT, MEDIUM, LONG RANGE ROCKET
 - USER DEFINED
- SELECT POINT IN WEAPON LOCATION
- SPECIFY WEAPON LOCATION COORDINATES
- SELECT POINT IN TARGET LOCATION
- SPECIFY TARGET LOCATION COORDINATES



SINGLE WEAPON TRAJECTORY MENU

Single Weapon Trajectory

Available Weapon Types

- light_mortar
- medium_mortar
- heavy_mortar
- light_artillery
- medium_artillery
- heavy_artillery
- short_rocket
- medium_rocket
- longrange_rocket

Weapon Selected

NONE SELECTED

Weapon Location

◆ Point ◆ Area

Easting, m

Northing, m

UTM Zone

Designation

Density ◆ Low ◆ Medium ◆ High

Target Location

◆ Point ◆ Area

Easting, m

Northing, m

UTM Zone

Designation

Density ◆ Low ◆ Medium ◆ High

Radar-Weapon Range 0.00 km

Radar-Weapon Azimuth 0.00 mils

Radar-Target Range 0.00 km

Radar-Target Azimuth 0.00 mils

Weapon-Target Range 0.00 km

Min. Firing QE (mils) 0.00

Max. Firing QE (mils) 0.00

Enter Firing Parameters Here

QE (mils)

Velocity (m/s)

Status: Waiting for Input



SINGLE WEAPON TRAJECTORY POINT-TO-POINT (cont.)

- CLICK PRESS TO SAVE COORDINATES
TARGET
 - MIN AND MAX QE FOR SHOT ARE DETERMINED
 - DEFAULT OPTION IS LOW QE TRAJECTORY (800 MILS FOR MORTARS)
- SELECT QE
- CLICK APPROVE TRAJECTORY BUTTON
- CLICK EXIT MENU BUTTON



SINGLE WEAPON TRAJECTORY AREA-TO-AREA

- ON FFPAS MAIN MENU, CLICK ON HOSTILE WEAPON LOCATION ->
SINGLE WEAPON TRAJECTORY
- SELECT WEAPON TYPE
- SELECT AREA IN WEAPON LOCATION
- CLICK DEFINE AREA BUTTON TO DEFINE OR SELECT AREA
 - CLICK ONCE TO SHOW LIST OF STORED AREAS
 - SECOND CLICK OPENS COORDINATE MENU OR SELECTS STORED AREA
- SELECT SAMPLING DENSITY

LOW: 4 POINTS

MEDIUM: 9 POINTS

HIGH: 16 POINTS



SINGLE WEAPON TRAJECTORY AREA-TO-AREA (cont.)

- SELECT AREA IN TARGET LOCATION
- CLICK DEFINE AREA BUTTON TO DEFINE OR SELECT AREA
- SELECT SAMPLING DENSITY
- CLICK PRESS TO SAVE COORDINATES BUTTON
 - TRAJECTORY SOLUTIONS FOR ALL COORDINATE PAIRS ARE COMPUTED
 - DIALOG BOX WILL DISPLAY NUMBER OF SOLUTIONS FOUND
- SELECT QE
- CLICK APPROVE TRAJECTORY BUTTON
- ~~CLICK EXIT MENU BUTTON~~



DEFINE AREA

- CLICK DEFINE AREA BUTTON IN SINGLE WEAPON TRAJECTORY MENU
- ENTER COORDINATE PAIRS FOR CORNERS OF SELECTED AREA
 - ORDER DOES NOT MATTER
 - AREA NEED NOT BE RECTANGULAR--MUST BE CONVEX
- CLICK SAVE TO CHECK AND STORE COORDINATES
- CLICK SAVE FILE TO NAME AREA AND ADD TO LIST
- CLICK EXIT MENU TO RETURN TO SINGLE WEAPON TRAJECTORY MENU



DEFINE AREA (cont.)

Weapon/Target Area Coordinates

No Area Name Selected

Area Point 1		Area Point 2	
Easting, m	553510.00	Easting, m	553510.00
Northing, m	N 3825261.00	Northing, m	N 3825261.00
UTM Zone	14	UTM Zone	14
Area Point 4		Area Point 3	
Easting, m	553510.00	Easting, m	553510.00
Northing, m	N 3825261.00	Northing, m	N 3825261.00
UTM Zone	14	UTM Zone	14

Save Undo Save File Exit Menu Help

- **SAVE FILE BUTTON OPENS SAVE AREA DIALOG BOX**
- **ENTER AREA NAME IN SAVE AREA DIALOG BOX**

Save Area

Area Name

OK Cancel

- **CLICK OK TO STORE**



MULTIPLE WEAPON TRAJECTORY MENU

Multiple Weapon Trajectory

Weapon 1 Weapon 2 Weapon 3 Weapon 4 Weapon 5 Simultaneous Fire Independent Fire

Available Weapon Types

- light_mortar
- medium_mortar
- heavy_mortar
- light_artillery
- medium_artillery
- heavy_artillery
- short_rocket
- medium_rocket
- longrange_rocket

Weapon Selected

NONE SELECTED

Weapon Location

Easting, m 553510.00

Northing, m N 3825261.00

UTM Zone 14

Designation 553510-3825261

Target Location

Easting, m 553510.00

Northing, m N 3825261.00

UTM Zone 14

Designation 553510-3825261

Press to Save Coordinates

Radar-Weapon Range 0.00 km

Radar-Weapon Azimuth 0.00 mils

Radar-Target Range 0.00 km

Radar-Target Azimuth 0.00 mils

Weapon-Target Range 0.00 km

Min. Firing QE (mils) 0.00

Max. Firing QE (mils) 0.00

Enter Firing Parameters Here

Low QE High QE

QE (mils) 0.00

Velocity (m/s) 0.00

Approve Trajectory

Status: Waiting for Input

Undo Selections Cancel Exit Menu Help



MULTIPLE WEAPON

TRAJECTORY

- ON FFPAS MAIN MENU, CLICK ON HOSTILE WEAPON LOCATION ->
MULTIPLE WEAPON TRAJECTORY
- CONSTRUCT UP TO FIVE POINT-TO-POINT TRAJECTORIES BY REPEATING SINGLE WEAPON POINT-TO-POINT PROCEDURE
 - SELECT WEAPON TYPE
 - SPECIFY WEAPON LOCATION COORDINATES
 - SPECIFY TARGET LOCATION COORDINATES
 - CLICK **PRESS TO SAVE COORDINATES** BUTTON
 - SELECT QE
 - CLICK **APPROVE TRAJECTORY** BUTTON



MULTIPLE WEAPON TRAJECTORY

(cont.)

- SELECT TRAJECTORY IN SEQUENCE BY CLICKING ON WEAPON NUMBER RADIO BUTTONS
- CLICK UNDO BUTTON TO REMOVE TRAJECTORIES FROM SEQUENCE IN DESCENDING ORDER
- SELECT SIMULTANEOUS FIRE OR INDEPENDENT FIRE
 - SIMULTANEOUS FIRE: SHOTS ARE FIRED AT SAME TIME. PERFORMANCE REFLECTS MULTIPLE SIMULTANEOUS ACTIVE TRACKS
 - INDEPENDENT FIRE: SHOTS ARE FIRED AND LOCATED ONE AT A TIME. PERFORMANCE REFLECTS SINGLE ACTIVE TRACK
- ~~WHEN SET IS COMPLETE~~ CLICK EXIT MENU BUTTON



VOLLEY FIRE TRAJECTORY

MENU

Available Weapon Types

light_mortar
medium_mortar
heavy_mortar
light_artillery
medium_artillery
heavy_artillery
short_rocket
medium_rocket
longrange_rocket

Weapon Selected

NONE SELECTED

Volley Fire Center Location

Easting, m553510.00

Northing, mN3825261.00

UTM Zone14

Designation553510-3825261

Weapons In Battery3456

27

Weapon Dispersion (m)

Target Location

Easting, m553510.00

Northing, mN3825261.00

UTM Zone14

Designation553510-3825261

Press to Save Coordinates

Radar-Weapon Range0.00 km

Radar-Weapon Azimuth0.00 mils

Radar-Target Range0.00 km

Radar-Target Azimuth0.00 mils

Weapon-Target Range0.00 km

Min. Firing QE (mils)0.00

Max. Firing QE (mils)0.00

Enter Firing Parameters Here

Low QELow QE

High QELow QE

QE (mils)0.00

Velocity (m/s)0.00

Approve Trajectory

Status: Waiting for Input

Undo

Cancel

Exit Menu

Help



VOLLEY FIRE TRAJECTORY

- ON FFPAS MAIN MENU, CLICK ON HOSTILE WEAPON LOCATION -> VOLLEY FIRE TRAJECTORY
- CONSTRUCT TRAJECTORIES FOR A BATTERY OF A SINGLE WEAPON TYPE FIRING AT ONE TARGET LOCATION
 - MORTAR
 - 3 TO 6 WEAPONS IN BATTERY
 - 15 - 40 METER DISPERSION (CIRCULAR ABOUT SPECIFIED LOCATION)
 - ARTILLERY/ROCKETS
 - 3 TO 6 WEAPONS IN BATTERY
 - 40 - 80 METER DISPERSION (LINEAR ABOUT SPECIFIED LOCATION. PERPENDICULAR TO LINE OF FIRE)

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VOLLEY FIRE TRAJECTORY

(cont.)

- FIRING TIMES SPACED EQUALLY OVER TWO SECOND INTERVAL

• SIMILAR TO SINGLE WEAPON POINT-TO-POINT PROCEDURE

- SELECT WEAPON TYPE

- SPECIFY VOLLEY FIRE CENTER LOCATION COORDINATES

- SPECIFY NUMBER OF WEAPONS IN BATTERY AND DISPERSION

- SPECIFY TARGET LOCATION COORDINATES

- CLICK **PRESS TO SAVE COORDINATES** BUTTON

- SELECT QE

~~CLICK **APPROVE TRAJECTORY** BUTTON~~



WHEN SET IS COMPLETE CLICK EXIT MENU

FRIENDLY FIRE LOCATION



- FFPAS COMPUTES PROBABILITY OF LOCATION AND CIRCULAR ERROR PROBABILITY (CEP) OF A SPECIFIED TRAJECTORY BY MODELING THE FRIENDLY FIRE LOCATION MODES OF THE FIREFINDER RADAR
- SPECIFIED TRAJECTORY IS GENERATED AND ANALYZED, PERFORMANCE RESULTS DISPLAYED ON VARIOUS OUTPUTS



FRIENDLY FIRE LOCATION MENU

Available Weapon Types

light_mortar
medium_mortar
heavy_mortar
light_artillery
medium_artillery
heavy_artillery

Weapon Selected

NONE SELECTED

◇ Mortar Impact Predict

◇ Artillery Impact Predict

Battery Position

Easting, m553510.00

Northing, mN3825261.00

UTM Zone14

Designation553510-3825261

Endpoint Position

Easting, m553510.00

Northing, mN3825261.00

UTM Zone14

Designation553510-3825261

Max Ordinate, m0.00

Fall Angle, mils0.00

Press to Save Coordinates

Radar-Weapon Range0.00 km

Radar-Weapon Azimuth0.00 mils

Radar-Target Range0.00 km

Radar-Target Azimuth0.00 mils

Weapon-Target Range0.00 km

Min. Firing QE (mils)0.00

Max. Firing QE (mils)0.00

Trajectory Firing Parameters

QE (mils)0.00

Velocity (m/s)0.00

Approve Trajectory

Status: Waiting for Input

Undo Selections

Cancel

Exit Menu

Help



FRIENDLY FIRE LOCATION

- ON FFPAS MAIN MENU, CLICK ON FRIENDLY FIRE LOCATION
- SELECT WEAPON TYPE
 - LIGHT, MEDIUM, HEAVY MORTAR
 - LIGHT, MEDIUM, HEAVY ARTILLERY
 - USER DEFINED MORTAR OR ARTILLERY
- IMPACT PREDICT MODE IS SET BY WEAPON TYPE BUT CAN BE MANUALLY OVERRIDDEN
- SPECIFY BATTERY POSITION COORDINATES
- SPECIFY ENDPOINT POSITION COORDINATES
- SPECIFY TRAJECTORY MAXIMUM ORDINATE
- SPECIFY TRAJECTORY FALL ANGLE



GENERATE PERFORMANCE OUTPUTS



- CHOOSE DESIRED PLOT SIZE
 - FULL SCREEN
 - STANDARD



GENERATE PERFORMANCE OUTPUTS (cont.)

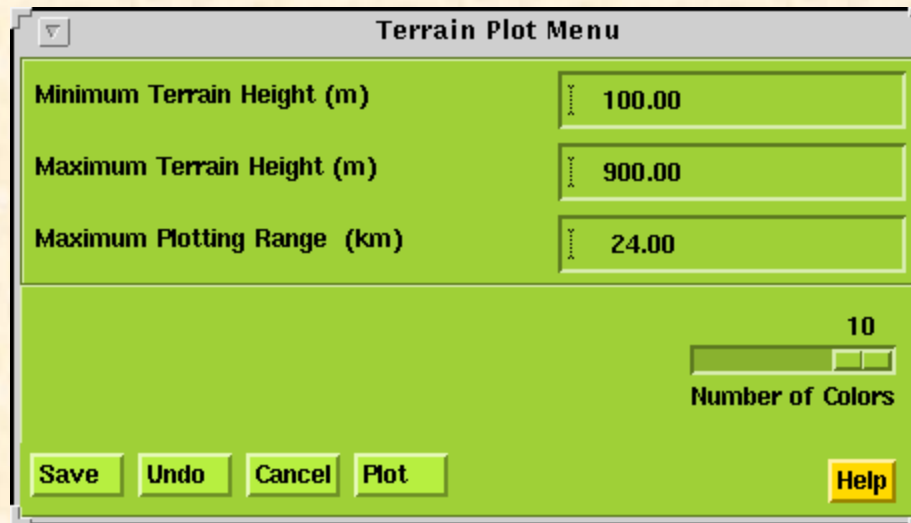


• CLICK ON PLOTS BUTTON ON FFPAS MAIN MENU, THEN ON DESIRED PLOT TYPE

- TERRAIN PLOT
- SCREEN ANGLE PLOT
- ELEVATION PLOT
- CLUTTER PLOT
- VISIBILITY PLOT
- TRAJECTORY TIR PLOT
- CURRENT SHOT SPREADSHEET
- ALL SHOTS SPREADSHEET



GENERATE TERRAIN PLOT



The screenshot shows a 'Terrain Plot Menu' dialog box with a light green background. It contains three input fields for 'Minimum Terrain Height (m)', 'Maximum Terrain Height (m)', and 'Maximum Plotting Range (km)', each with a 'Default' label and a value of 100.00, 900.00, and 24.00 respectively. Below these is a 'Number of Colors' slider set to 10. At the bottom are buttons for 'Save', 'Undo', 'Cancel', 'Plot', and 'Help'.

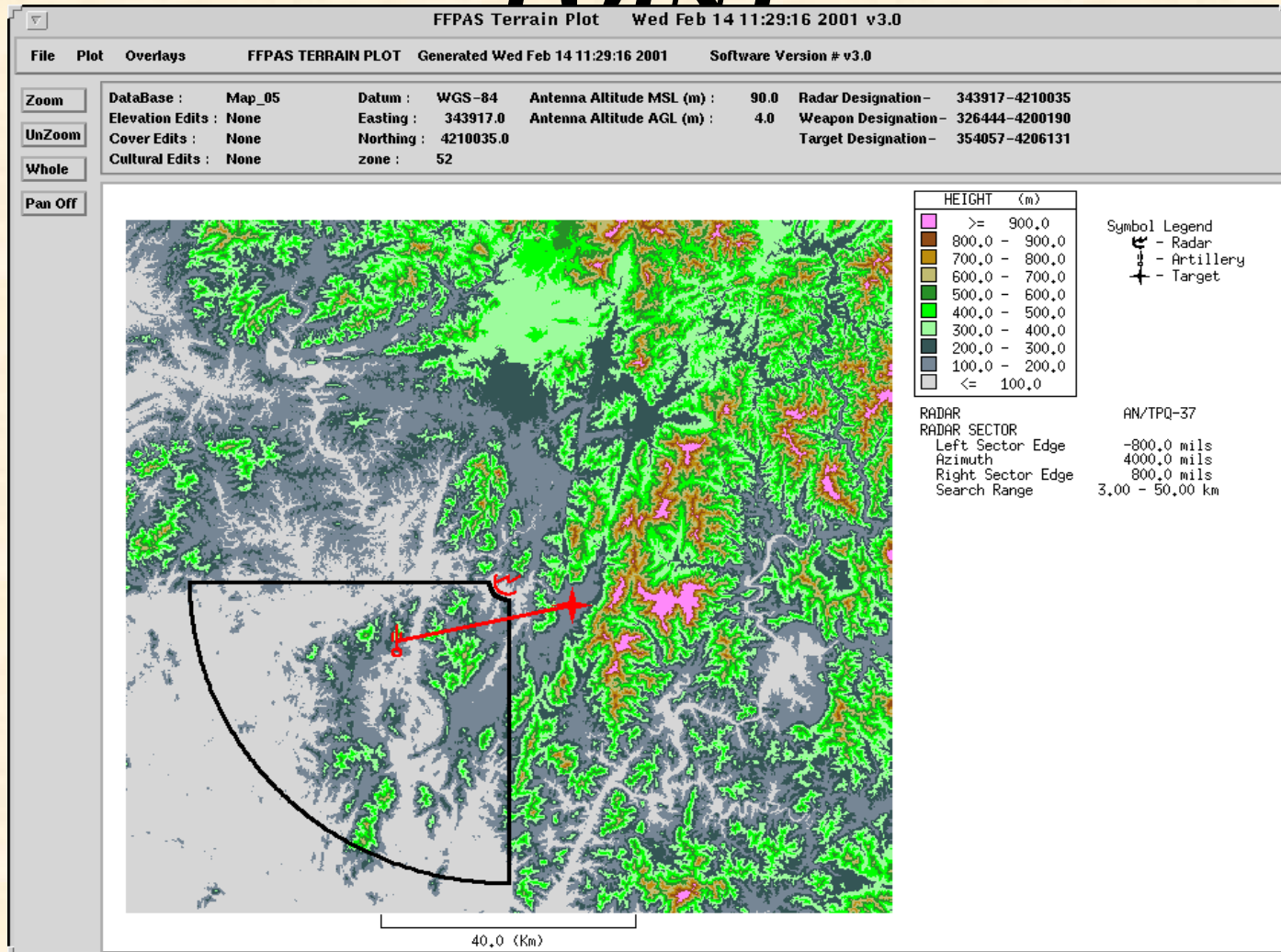
Parameter	Value
Minimum Terrain Height (m)	100.00
Maximum Terrain Height (m)	900.00
Maximum Plotting Range (km)	24.00
Number of Colors	10

- TOPOGRAPHIC MAP OF REGION SURROUNDING RADAR SITE
 - THE HT MUST BE BETWEEN -1000 AND 50000 METERS, AND THE RANGE NO GREATER THAN 159.5 KILOMETERS
 - COLOR CODES INDICATE GROUND HEIGHT ABOVE MEAN SEA LEVEL
 - OVERLAYS INDICATE SEARCH SECTOR, WEAPON TRAJECTORY
 - TRAJECTORY LOCATION STATISTICS INCLUDED ON AREA-TO-AREA PLOTS



TERRAIN PLOT

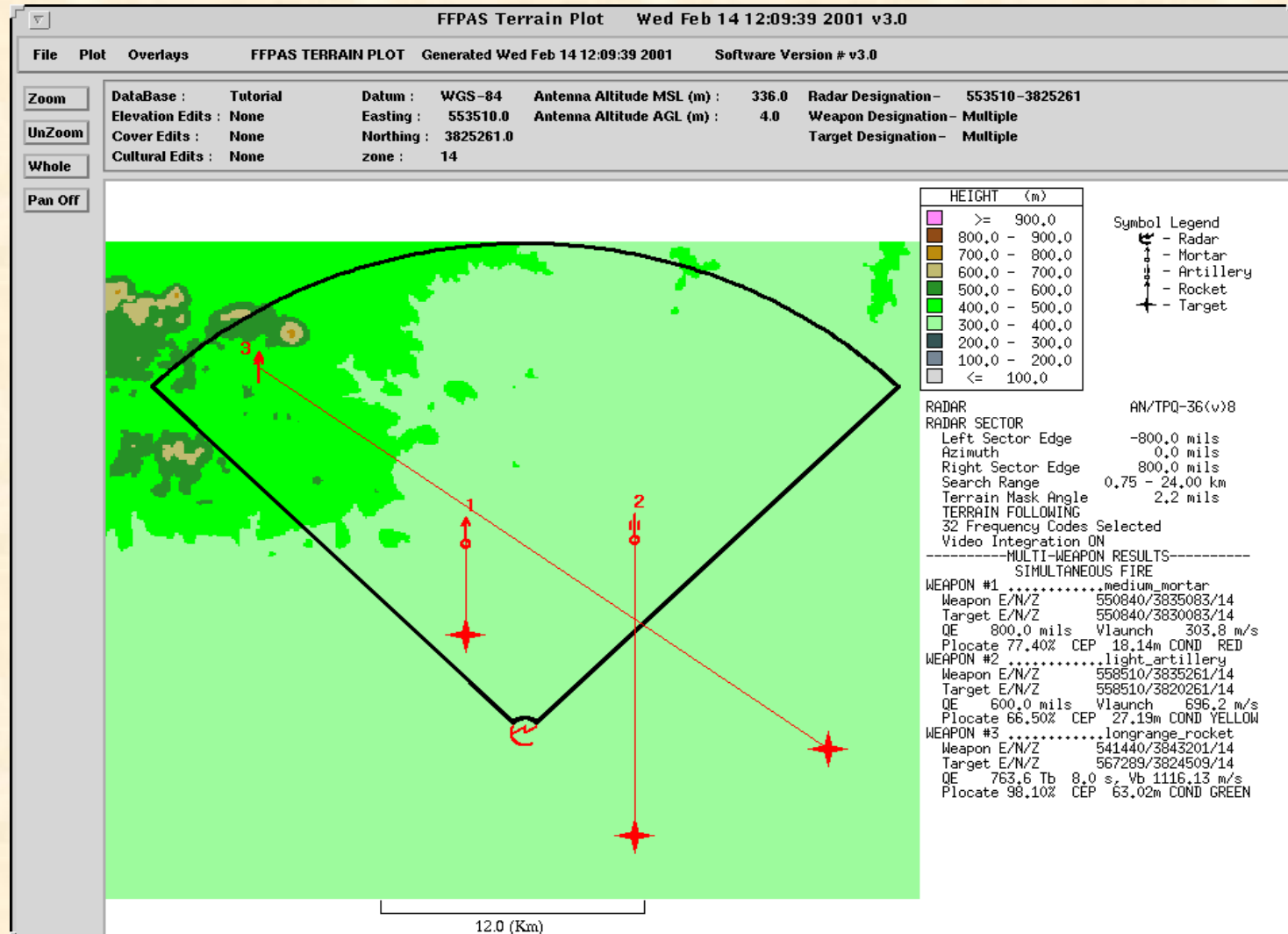
SINGLE WEAPON POINT-TO-POINT



USMC



TERRAIN PLOT MULTIPLE WEAPON



USMC



GENERATE SCREEN ANGLE PLOT

Screen Angle Plot Menu

Minimum Plotting Range (km)	2.40
Maximum Plotting Range (km)	24.00
Minimum Screening Angle (mils)	0.00
Maximum Screening Angle (mils)	800.00

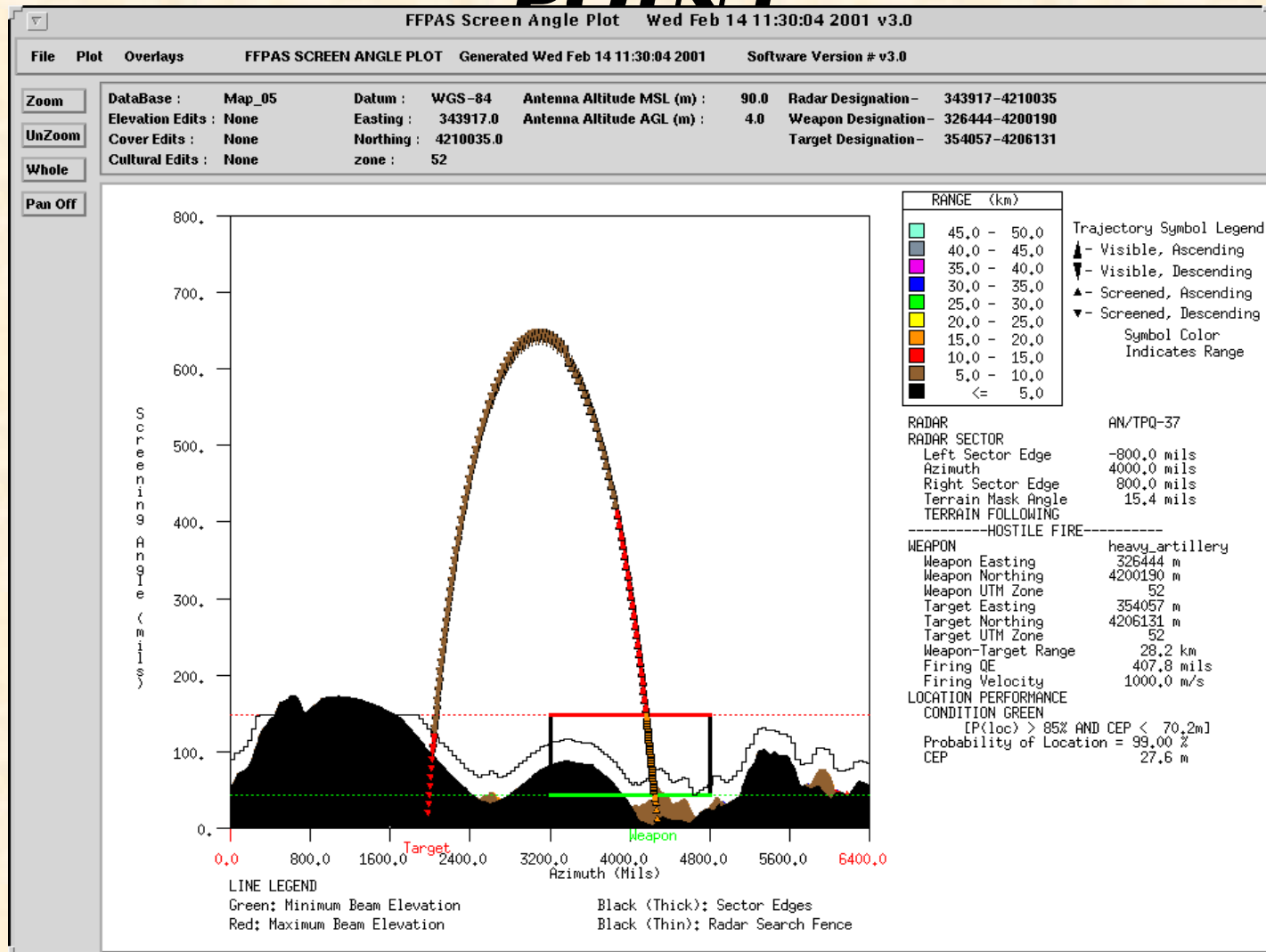
10
Number of Ranges

Save Undo Cancel Plot Help

- DISPLAYS COLOR CODED TERRAIN MASK IN PANORAMIC VIEW
 - COLOR CODES INDICATE RANGE TO SCREENING TERRAIN
 - TRAJECTORY DETAILS AND LOCATION STATISTICS DISPLAYED FOR ALL TRAJECTORY ANALYSES
 - OVERLAYS INDICATE SEARCH SECTOR, SEARCH FENCE, WEAPON TRAJECTORY
- SPECIFY PLOT ATTRIBUTES
- CLICK ON SAVE, THEN PLOT



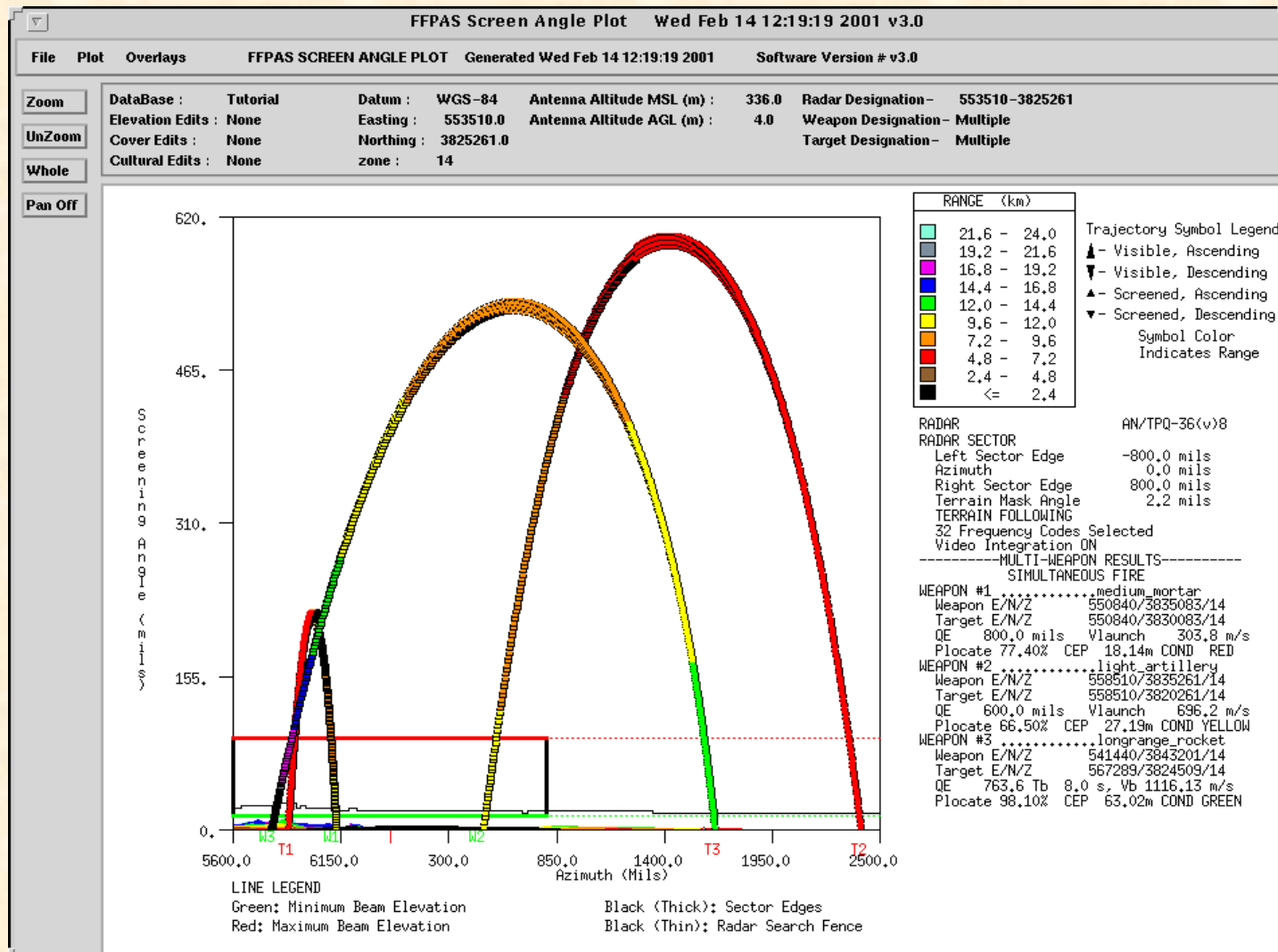
SCREEN ANGLE PLOT SINGLE WEAPON POINT-TO-POINT



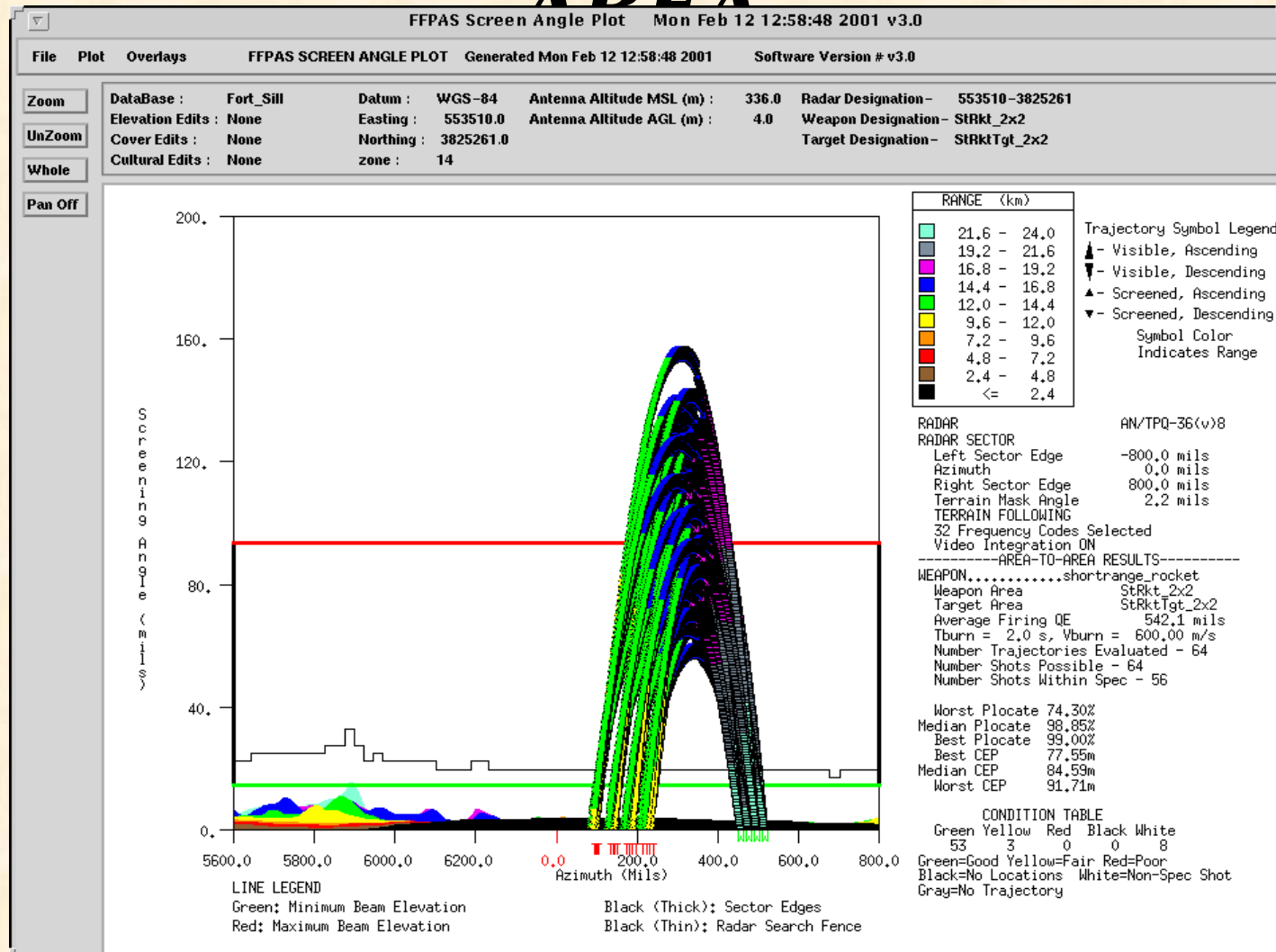
USMC



SCREEN ANGLE PLOT MULTIPLE WEAPON



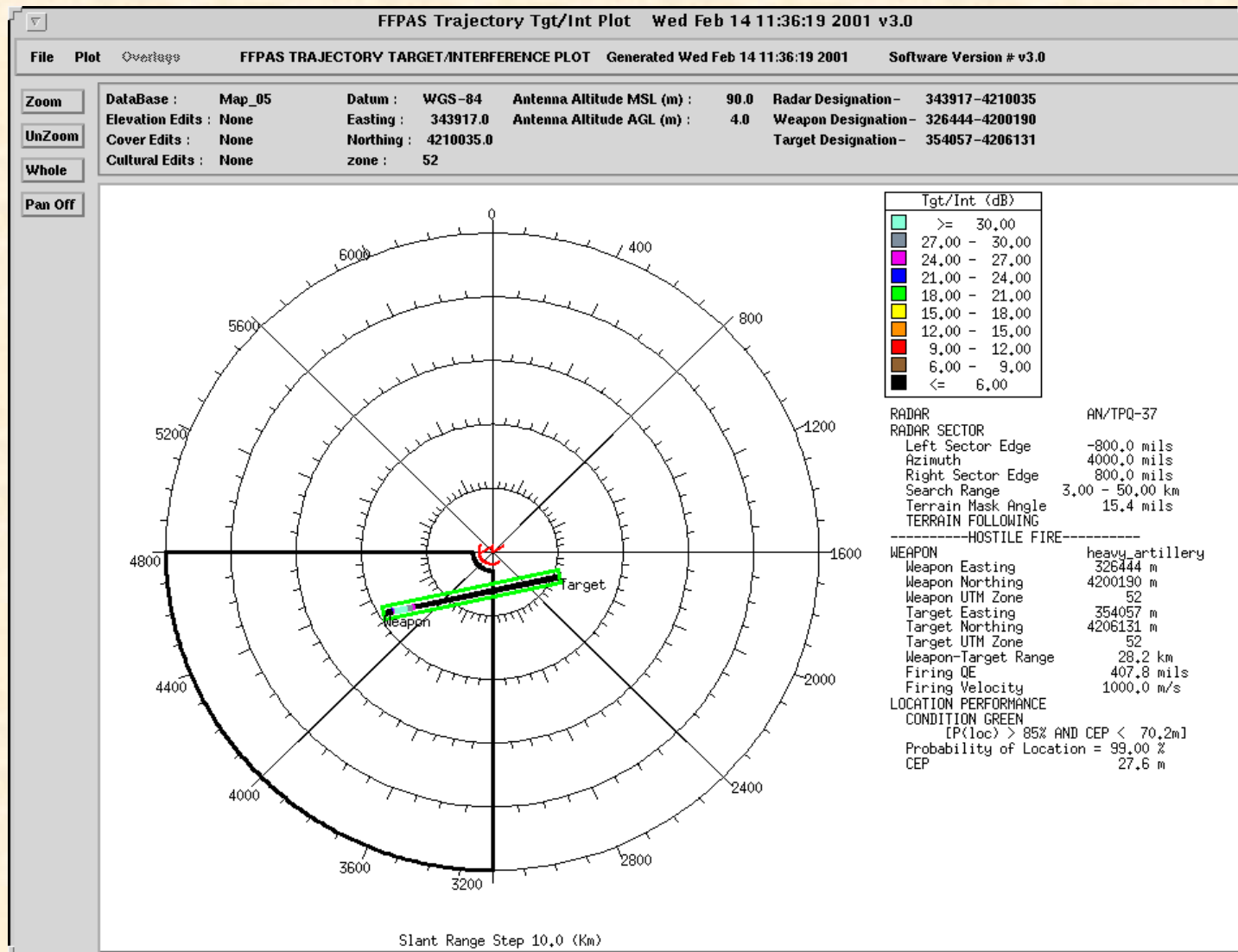
SCREEN ANGLE PLOT SINGLE WEAPON AREA-TO- AREA



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TRAJECTORY TIR PLOT



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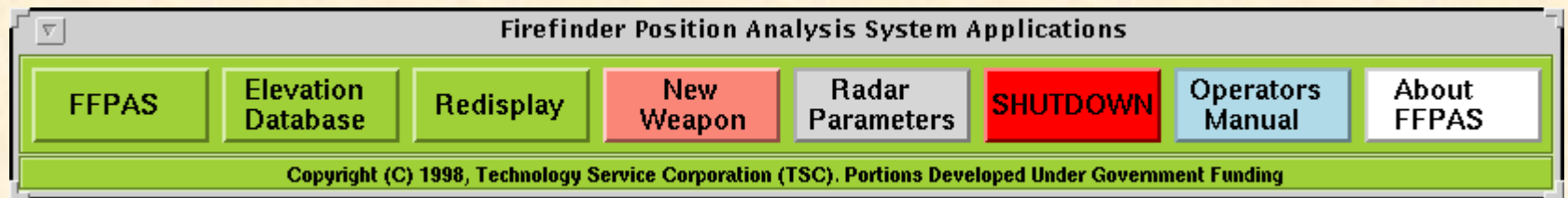


TUTORIALS

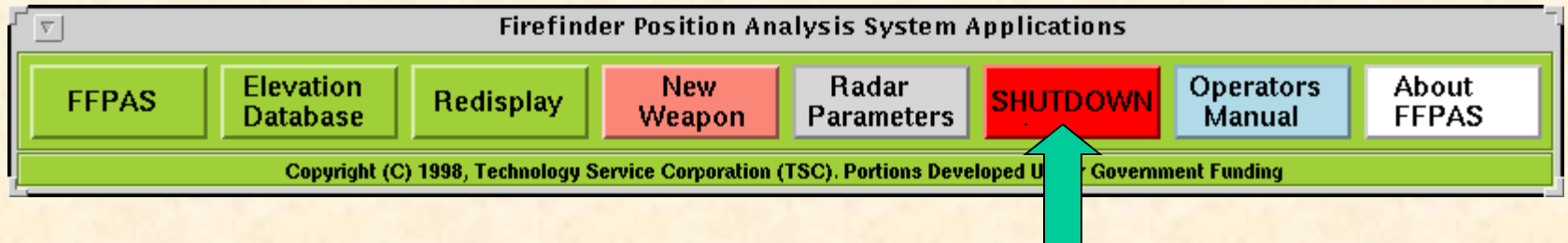


- GUIDE OPERATOR THROUGH STEPS TO PERFORM SAMPLE ANALYSES
 - POINT-TO-POINT
 - AREA-TO-AREA
 - MULTI-WEAPON
 - VOLLEY FIRE
 - FRIENDLY FIRE
- PROVIDES ADDITIONAL INFORMATION ABOUT PERFORMANCE ASSESSMENT MESSAGES



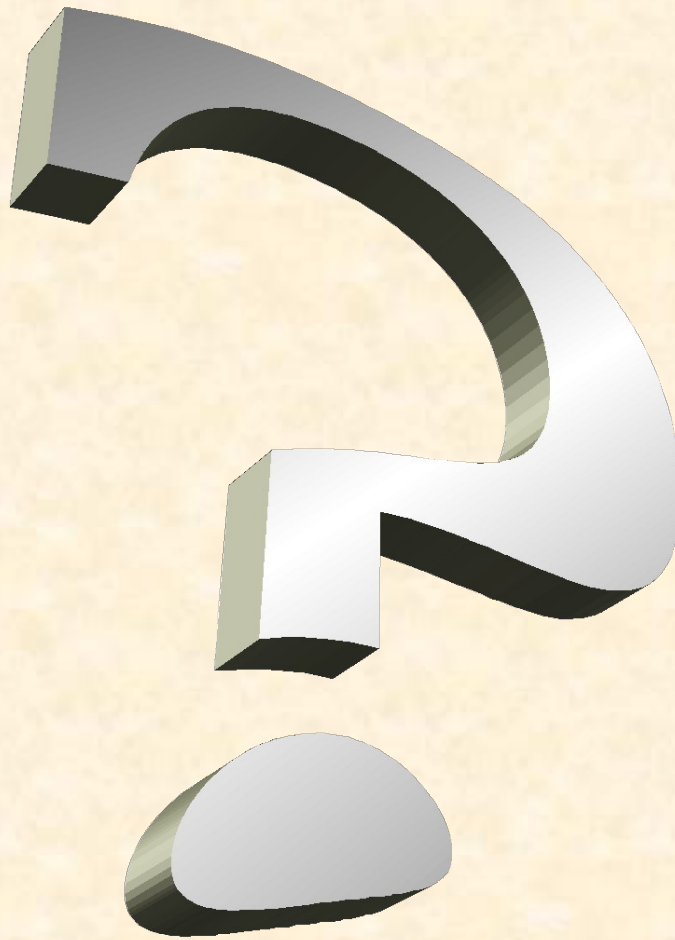


SHUTDOWN



- CLICK SHUTDOWN BUTTON OF FFPAS APPLICATIONS MENU TO STOP ALL FFPAS OPERATIONS
 - MENUS
 - PROCESSING
 - PLOTS
- FFPAS APPLICATIONS MENU WILL CLOSE WHEN SHUTDOWN IS COMPLETE





Questions

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